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FINAL PROGRESS REPORT

A BHC AQUEOUS EMULSION SPRAY AS A PREVENTIVE
CONTROL FOR THE BLACK TURPENTINE BEETLE IN LOGGING AREAS

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This study was undertaken to determine if a 1.0 percent gamma benzene hexachloride (BHC) water emulsion, rather than the commonly used BHC-diesel oil solution would prevent establishment of the black turpentine beetle, Dendroctonus terebrans (Oliv.) in stumps and damaged residual trees.

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Study plots were established in recently cut-over stands on the Winn District, Kisatchie National Forest, Louisiana. Spray treatments were applied on June 24 and 25, 1963. Specific objectives were to find:

(1) If the BHC water emulsion when applied to recently cut stumps would prevent infestation.

(2) If the BHC water emulsion (a) without an additive, (b) with an extender (Aroclor), or (c) with a wetting agent (Flameout, presently named "7-11") would protect damaged trees from attack until they had recovered from stand disturbances.

The extender was added to prolong the residual effectiveness of the insecticide. The wetting agent was added to increase penetration of the emulsion into the bark to better protect the BHC from being washed away by rain.

1/ Bennett, Wm. H. Study Plan: A BHC aqueous emulsion spray as a preventive control for the black turpentine beetle in logging areas, April 1, 1963.

2/ Establishment Report: A BHC aqueous emulsion spray as a preventive control for the black turpentine beetle in logging areas, July 9, 1963.

Plot Design and Treatments

Four locations (blocks), each containing 10 representative stumps and 20 representative damaged trees were selected. Stumps were randomly assigned to one of two treatments and trees to one of four treatments. Thus there were five completely random replications of six treatments in every block. Treatments were as follows:

1. Stumps sprayed with BHC water emulsion.
2. Unsprayed stumps.
3. Trees sprayed with BHC water emulsion.
4. Trees sprayed with BHC water emulsion plus Aroclor (1/2 pound of Aroclor 5460 dissolved in 1/2 pint of Xylene to each 5 gallons of emulsion).
5. Trees sprayed with BHC water emulsion plus "7-11" (one part of "7-11" to 100 parts of emulsion by volume).
6. Unsprayed trees.

Observations and Results

1. Stump Treatments

Based on external symptoms, the number of beetle attacks on sprayed and unsprayed stumps was recorded 1, 2, 3, and 3-1/2 months after treatment.

All unsprayed stumps became infested within the first month, and 104 attacks occurred in a 3-month period. After 3 months, no recent activity was observed and stumps were considered no longer attractive

to the beetle. Termites were invading the outer bark, and some had entered the cambial region near the root collar.

One sprayed stump sustained a single attack 2 months following treatment, and a second was recorded at 3-1/2 months in what appeared to be a root-grafted stump. Here, the stump had probably remained attractive to the beetle after the toxicity of the BHC had failed. A further indication of the limited action of the water emulsion was the presence of ambrosia beetles (Platypus sp.) in most stumps 2-1/2 to 3 months after spraying.

The effectiveness of treatment was determined by a modification of Abbott's formula as follows:

$$\text{Percent effectiveness} = \frac{\text{Total counts in check} - \text{total counts in test}}{\text{Total counts in check}} \times 100$$

Based on the number of successful attacks, the degree of preventive control was 98 percent. On the number of stumps attacked, protection was 90 percent effective.

2. Damaged Tree Treatments

Beetle activity was recorded 1 month, 3 months, and 6 months after treatment (Table 1). Counts were based on pitch tubes, which were typical of attacks several inches or more above the ground, or deposits of resin particles that were associated with root collar entrance holes.

Table 1. Number of attacks 1 month, 3 months, and 6 months after treatment.

Tree No.		1% BHC + H ₂ O			1% BHC + H ₂ O + Arochlor			1% BHC + H ₂ O + wetting agent			Unsprayed		
BLOCK I	1	0	0	0	0	0	0	0	0	0	0	2	1
	2	0	0	0	0	0	0	0	0	0	7	5	5
	3	0	0	0	0	0	0	0	0	0	0	4	2
	4	0	0	0	0	0	0	0	0	0	0	4	1
	5	0	0	0	0	0	0	0	0	0	0	5	6
	Totals	0	0	0	0	0	0	0	0	0	0	7	20
BLOCK II	1	0	0	1	0	0	4	0	0	0	23	23**	23
	2	0	0	2	0	0	0	0	0	0	1	0	0
	3	0	0	0	0	0(1)*	0(1)*	0	0	0	2	2	0
	4	0	1	0	0	0	0	0	0	0	6	4	9
	5	0	0	0	0	0	0	0	0	0	4	3	1
	Totals	0	1	3	0	0	4	0	0	0	36	32	33
BLOCK III	1	0	0	0	0	0	0	0	0	1	8	10**	10
	2	0	1	1	0	0	1	0	0	0	3	6**	6
	3	0	0	0	1	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	2	1	2
	5	0	0	0	0	0	0	0	0	0	2	1	2
	Totals	0	1	1	1	0	1	0	0	1	15	18	20
BLOCK IV	1	0	0	0	0(2)*3-(1)* 3			0	0	0	2	1	1
	2	1	0	1	0	0	1	0	0	0	8	7**	7
	3	0	0	3	0	0	0	0	0	0	0	0	0
	4	0	0	2	0	0	0	0	0	1	2	5**	5
	5	0	0	1	0	0	0	0	0	0	1	0	0
	Totals	1	0	7	0	3	4	0	0	1	13	13	13
Grand TOTAL		1	2	11	1	3	9	0	0	2	71	83	81

* - above sprayed area

** accidentally sprayed by control crews

One month after spraying, 14 unsprayed trees had 71 attacks. A single attack occurred in the BHC emulsion and in the BHC emulsion-Aroclor treatment, but none was observed on trees sprayed with the BHC emulsion plus the wetting agent.

By the sixth month, unsprayed trees had 81 attacks. Eleven and nine were recorded in the BHC emulsion and the BHC emulsion-Aroclor treatments, respectively. Only two attacks were found on stumps sprayed with the BHC emulsion-wetting agent formulation. Supplementary examinations showed that these two were made after the fifth month.

External symptoms of some attacks disappeared between inspections, particularly where resin particle deposits were used as evidence. Because of the high value of the residual trees, bark removal for further study was not undertaken. Whether parent beetles failed to establish broods, or whether external signs of activity ceased naturally after egg deposition, was not determined.

Analysis of data is based on the total numbers of apparently successful attacks over the 6-month period, disregarding those made above the sprayed portion of several trees.

Five check trees were accidentally sprayed by control crews two months after plot establishment, and pitch tubes on these trees disintegrated following arrested beetle development. Counts made at the time of spraying were used in final calculations.

Following are the estimated numbers of attacks and numbers of trees infested for each 20-tree treatment:

Treatment	No. of Attacks	No. of Trees
BHC emulsion	12	7
BHC emulsion plus extender	10	5
BHC emulsion plus wetting agent	2	2
Unsprayed	96	18

The effectiveness of treatment was determined by Abbott's formula as follows:

$$\text{Percent effectiveness} = \frac{\text{Total counts in check} - \text{total counts in test}}{\text{Total counts in check}} \times 100$$

On the basis of number of attacks, the degree of preventive control was:

	<u>Percent</u>
BHC emulsion	88
BHC emulsion plus extender	90
BHC emulsion plus wetting agent	98

Based on the number of trees attacked, the degree of protection was:

BHC emulsion	61
BHC emulsion plus extender	72
BHC emulsion plus wetting agent	89

Summary and Recommendations

A 1.0-percent-gamma-BHC-water emulsion, when applied to recently cut stumps, will effectively prevent infestation for the period that beetles are attracted to them, or approximately 3 months. Based on the number of beetle attacks and on the number of stumps infested, the degree of preventive control was 98 and 90 percent, respectively.

Trees that had been damaged by logging remained subject to infestation for at least 6 months. During this period the BHC-water emulsion plus a wetting agent provided better protection than the water emulsion alone or with the addition of an extender. Based on the number of beetle attacks and on the number of stumps infested, the degree of preventive control was 98 and 89 percent, respectively.

In concluding the study, it is recommended that:

1. Damaged-tree plots be re-examined next spring and early summer to further appraise the residual action of treatments, and that results be submitted in a supplementary report.
2. An administrative study be undertaken in cooperation with National Forest Administration to test the BHC-wetting agent formulation under actual control conditions.
3. A new study be executed to evaluate the BHC-emulsion-wetting agent formulation as a remedial control for the southern pine beetle.